

## EPA's 2011 Modeling Platform – Base Year (2011) Q&A

EPA will be using data from the 2011 National Emissions Inventory (NEI) as the starting point for developing its 2011 modeling platform. This platform will be used during 2013 and 2014 to support EPA air quality modeling activities, possibly including interstate transport analyses, the ozone NAAQS review Regulatory Impact Assessment, the 2011 National Air Toxics Assessment (NATA), among others. There is a separate Q&A document that addresses questions related to the future year.

Here we give more explanation of what “using the 2011 NEI data” means and the assumptions used in building the NEI. You can find additional information on our latest approaches used for our 2007-based modeling platform on the [Emissions Modeling Clearinghouse](#). The Technical Support Document on the Emissions Platform for the Final Rule PM NAAQS regulatory impact assessment provides the latest detailed information about our approaches.

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**Q1: Where is the website for the 2011 emissions modeling platform data?**

Modeling data and outreach info: <http://www.epa.gov/ttn/chief/emch/index.html>

Draft Version 1 mobile sources and fires: [ftp://ftp.epa.gov/EmisInventory/2011nei/2011nei\\_draft/](ftp://ftp.epa.gov/EmisInventory/2011nei/2011nei_draft/)

The Emission Inventory System (EIS) can also be used to run reports on the 2011 NEI Draft and the 2011 NEI v1 when it’s available. See the EIS Gateway site at <http://www.epa.gov/ttn/chief/eis/gateway/index.html>.

**Q2: Since the NEI is annual, how can EPA use it in modeling?**

Where available, EPA sums sub-annual data to annual values to populate the NEI, but more finely resolved data are used in modeling. This is true for on-road mobile, nonroad equipment, wildfires and prescribed burning, and biogenic emissions. For data sources that only have annual values, such as for non-EGU point sources and nonpoint sources, EPA applies various temporal allocation schemes to the data to allocate it to the hourly data needed for air quality modeling.

**Q3: What emissions sectors use sub-annual data in modeling, and what does that have to do with the “NEI”?**

The approaches used depend on the emissions sector. Where noted here, the detailed sub-annual data are summed to use in the NEI’s annual value, which is how these data relate to the NEI.

- On-road mobile: Motor Vehicle Emissions Simulator (MOVES) is run to get emission factors and the Sparse Matrix Operator Kernel Emissions (SMOKE) system combines vehicle miles traveled (VMT) and vehicle population with emission factors. This “SMOKE-MOVES” approach uses gridded, hourly meteorology to select the emission factors to use, interpolating between factors at different temperatures where needed. Emission factors from MOVES are based on state-supplied MOVES inputs and VMT where these have been provided through the NEI process (details about which inputs are used in a given version of the NEI are provided as part of the NEI documentation – see also Q23:). The NEI also has annual emissions provided by some states, including California. California uses a different EPA-approved model called EMFAC. California has provided sub-annual data for use in our modeling platform, which are consistent with the annual totals in the NEI.
- Non-road mobile: The National Mobile Inventory Model (NMIM) runs the NONROAD model to get monthly nonroad equipment emissions. The modeling platform uses the monthly data and applies day-of-week, and hour-of-day adjustments. These monthly data are summed and used in the NEI’s annual value, except where states have provided annual emissions, which are used in the NEI. California has provided annual data to the NEI using their OFFROAD model, and provided separately more detailed and consistent data for use in the modeling platform.
- Electric Generating Utilities: EPA uses the hourly CEM data to temporally allocate NEI emissions. In the NEI, we check that the data provided by states matches the CEM data for units that submit CEM data for the entire year. We use the state-submitted data (except for some cases of HAP emissions that do not have source tests or CEMs). This allows us to make sure we have all emissions for those units who are sub-annual reporters to the CEM program, but which the state reports annual emissions. In addition for regulatory modeling, an average-year temporal allocation approach is developed to keep temporal allocation consistent between the base and future years, to prevent modeling artifacts.
- Wildfires and Prescribed burning: We use the SMARTFIRE-based approach to estimate daily emissions for fires at point source locations. In the NEI, these are stored as point/daily values called “events”. These emissions get summed to annual totals for summaries of the NEI, but the more detailed data are used in modeling. In addition, for regulatory modeling, an average fires inventory is created and used for the base and future years, to prevent modeling artifacts.
- Biogenics: We use the BEIS3.14 model to create 12-km gridded hourly emissions that are used in modeling. These are allocated to counties using county area and summed to load county-annual values to the NEI. The modeling platform uses the more detailed gridded hourly emissions.

**Q4: For annual data, what temporal allocation approaches does EPA use to allocate emissions to hours?**

EPA has a variety of temporal allocation approaches that depend on the category of emissions. The [2007-based emissions platform Technical Support Document](#) provides more information on these approaches, but we summarize them here. Where appropriate, we account for issues like holidays and different allocations for Mondays, weekdays, and weekends.

- Residential wood combustion: a modeled meteorological-based allocation approach for annual-to-day and an hourly allocation approach from day-to-hour
- Agricultural ammonia: county-specific annual-to-month allocation and a modeled meteorological-based allocation approach for month-to-hour
- Fugitive dust: annual-to-week with meteorological week-to-day and day-to-hour factors specific to fugitive dust
- Agricultural burning: state-specific annual-to-month allocations, uniform day-of-week, and day-to-hour factors specific to agricultural burning
- All other, including non-EGU point sources, nonpoint, rail, C1 and C2 marine: SCC-specific annual-to-month, month-to-day of week, and day-to-hour.

We have formats that handle annual-to-month, month-to-day, month-to-day of week, and day-to-hour for each day of the week.

**Q5: The NEI has total Volatile Organic Compounds (VOC) and total PM2.5 Primary, but the modeling needs speciated emissions. How does EPA use the NEI when the model needs speciated emissions?**

EPA uses “speciation profiles” which are assigned to each emissions process from the NEI. The assignments are generally made by the source category code (SCC) in the NEI, but also the emissions mode (for activities like refueling, brake wear, and tire wear). The speciation profiles can also be applied by state, county, and even to specific facilities, but EPA does not usually have access to such information or it simply does not exist. This coordination effort could improve our speciation approach. Our latest speciation approaches are based on [SPECIATE4.3](#), and we are working to improve that usage for the 2011-based platform.

More information on our latest speciation approaches is available in our [2007-based emissions platform Technical Support Document](#).

**Q6: For sources other than point sources, how does EPA use the county total data for modeling, when the air quality models need gridded data?**

EPA uses “spatial surrogates” to spatially allocate emissions from county resolution to the 12-km grid cells used in modeling. We use 69 different spatial surrogates, which are assigned to allocate the emissions based on the SCC. These spatial surrogates have been updated recently and more details are available in the [2007-based emissions platform Technical Support Document](#).

**Q7: Does EPA use state data for EGUs, or does it get overwritten by other data?**

In the 2011 NEI and modeling platform, EPA plans to use state data in nearly all cases for EGU criteria pollutants and in many cases for EGU hazardous air pollutants. There are a few exceptions, mostly affecting the HAP emissions:

- For PM2.5, data were available from a limited number of units from a 2010 test program for the Mercury and Air Toxics Standard (MATS) rule development. Where state data relies on emission factors (rather than test data) and we have 2010 test data for both PM2.5 and PM-Condensable, EPA computed and used PM2.5 and PM10 emissions for those units based on 2011 activity from the CEM program.

- For HAP metals, Hydrogen Chloride, and Hydrogen Fluoride, EPA uses state data if the method code is CEM or stack test. Otherwise, EPA uses emission factors based on the MATS test data. These are both unit-specific data and averaged emission factors. EPA computed and used HAP metals for such uses based on 2011 activity from the CEM program.
- Using various methods, EPA tags as outliers (and does not use) any values that are extremely suspect. This is done for the entire inventory. At this time, we do not have any EGU CAPs tagged. Through the NEI process, state and local air agencies can see which values have been tagged and either correct the value (if needed) or verify the value is correct.

**Q8: How does EPA use the hourly data from the Continuous Emissions Monitoring (CEM) program for Electric Generating Utilities (EGUs)?**

See Question Q3: bullet for “Electric Generating Utilities”.

**Q9: How can I provide updated 2011 emissions to EPA for use in modeling?**

All 2011 emissions data needs to be submitted through the Emission Inventory System (EIS). EIS will be used as the submission mechanism for comments on 2011 emissions to EPA on the 2011 NATA and modeling platform review for any uses. Data for 2011 NEI version 1 can be submitted through 6am Eastern Daylight Time on May 8<sup>th</sup>. Onroad and Nonroad mobile input files for MOVES and NMIM can be submitted upon request by contacting Laurel Driver.

For questions on how to provide data through EIS, contact Sally Dombrowski or Madeleine Strum. Please refer to the [EPA Staff Directory](#) for contact information.

In limited cases, the NEI data may not be used in modeling. In these cases, EPA will work with commenters to establish a format to provide comments. Data provided in SMOKE-input format for use in the modeling platform is always welcomed.

**Q10: Why does EPA want the NEI and modeling platform to use the same emissions?**

The NEI and modeling platforms get used in a variety of ways to provide emissions to people both inside and outside the federal government. As a federal agency, EPA is often called upon to provide “the right number” for emissions estimated for many purposes, both internal and external to the agency. These purposes include rule development and support, international reporting, media inquiries, other high-profile EPA reports such as the Report on the Environment or the Trends Report.

When different numbers are published for the same purpose by the same group within EPA, others can understandably become confused about which emissions values are the “best” or the “right” answer. When the differences are not simply a version update, we spend a great deal of time having to explain why emissions values are different and why each is okay for their own purpose. This is time spent away from improving the inventory, modeling platform, or other inventory products. Thus, having the NEI and modeling platform data be as similar as possible allows us to spend less effort on explaining differences, and the time saved can be used for making better inventories.

**Q11: Does EPA know of any cases where the NEI data cannot be used in the modeling platform?**

In some cases, it is not possible or desirable to use the exact same data between the NEI and modeling. These are:

- For fugitive dust, the NEI calculation approach applies a annual-based meteorology adjustment that accounts for precipitation. For the modeling platform, EPA starts with unadjusted data and applies a more complex allocation based on more temporally resolved meteorological factors. This makes the total for these emissions different in the modeling as compared to the NEI.
- For on-road refueling VOCs, we use the results from SMOKE-MOVES in the modeling platform, whereas the NEI uses a combination of state-submitted nonpoint refueling and summed SMOKE-MOVES results for states that do not submit refueling VOCs. The SMOKE-MOVES based data are better for the modeling platform because they have a better spatial and temporal resolution, and they allow us to be consistent between the base and future years to capture fuel impacts of national EPA rules.
- For C3 marine, the NEI uses a combination of state submitted data EPA data. The EPA data are used only where states do not submit and are based on the modeling platform data created by OTAQ as part of the C3 marine rule. The modeling platform uses only the OTAQ rule-based data.

**Q12: In past inventories, EPA has added nonpoint data to the NEI that we do not have in our inventory and we think is wrong. What can we do about that?**

Nonpoint data can be erroneously added for sectors that can have both a point and nonpoint contribution. Since some states do not supply nonpoint data for some or all categories, EPA needs to decide whether to add nonpoint emissions to support the goal of having a complete inventory. The nonpoint emissions are based on methods arrived at in collaboration with state air agencies who participate.

To help EPA better understand state intents for their data for the 2011 NEI, we had issued a nonpoint survey in the fall of 2012 to help us better understand emissions sectors that can have point/nonpoint overlap. We asked states to indicate, for each relevant nonpoint SCC, whether the emissions are captured entirely in point sources, whether they do not have the sector (rare), whether to use EPA data, or whether the state does point/nonpoint reconciliation using the tools provided by EPA to do that.

We will use the survey to the greatest extent possible in building the NEI. However, results from the survey were mixed and some information provided is nonsensical. For example, some states indicated that they do not have “gasoline stage 2”, which is from gas stations. Other states indicated that all of their emissions from commercial and institutional natural gas combustion are captured in their point sources inventory. For this to be true, every mall, hospital, and office building would need to be included in their point sources inventory. A quick check of the point sources inventory reveals that no state includes all of these sources as point sources.

Thus, EPA will apply some discretion in interpreting the surveys. We anticipate that where states provided us this information, it will largely eliminate erroneous additions and prevent significant double counting.

To provide additional information to EPA on these issues, please contact Roy Huntley or Jennifer Snyder. Please refer to the [EPA Staff Directory](#) for contact information.

**Q13: How can I provide temporal allocation information for consideration by EPA?**

Temporal factors can be provided in SMOKE input format. These formats are available in the latest SMOKE documentation. See the [SMOKE website](#) for links to the latest documentation. The temporal allocation formats are available in Chapter 8 “SMOKE Input Files” under Section 8.3 “Temporal Allocation Files”. Additional types of temporal allocation factors that can be output from Gentpro or generated independently are described here: <http://www.smoke-model.org/version3.1/html/ch09s05.html>.

Temporal factors can be provided for:

- Year-to-month
- Year-to-day
- Week-to-day
- Day-to-hour (can be specific to each day of the week)

Files can be emailed to EPA contacts Alison Eyth, Rich Mason, and/or Alexis Zubrow. Please refer to the [EPA Staff Directory](#) for contact information.

**Q14: How can I provide chemical speciation information for consideration by EPA?**

Speciation factors can be provided in SMOKE input format. These formats are available in the latest SMOKE documentation. See the [SMOKE website](#) for links to the latest documentation. The chemical speciation formats are available in Chapter 8 “SMOKE Input Files” under Section 8.5 “Chemical Speciation”.

Files can be emailed to EPA contacts Alison Eyth, Rich Mason, and/or Alexis Zubrow. Please refer to the [EPA Staff Directory](#) for contact information.

**Q15: Why doesn’t EPA use link-level emissions data?**

For national scale modeling, it is technically infeasible at this time to use link-level mobile source emissions data (i.e., emissions allocated to grid cells based on calculations made for individual road segments). This is not feasible primarily because we need to use consistent approaches across the country for equity in our work, and the resources (time, funding, and computational resources) needed to perform link-level modeling everywhere are currently out of reach. In addition to the base year modeling, link-level emissions would also need to be created for the future years, further compounding the resource challenge. For local scale modeling, EPA has in the past used link-level emissions.

**Q16: What do we do if the NEI causes a “filter” to our data because of limitations on SCCs?**

If data are available at more finely resolved processes/SCCs than are available in the NEI, there are two steps. First, summed data should be submitted to EPA through the EIS for use in the NEI. Second, the more finely resolved data should be provide to EPA (email or FTP as appropriate) using SMOKE FF10 input format with an explanation of why the more detailed data is critical to EPA’s modeling platform. If the reason is because of temporal allocation, spatial allocation, or chemical speciation , that additional information will need to also be provided to EPA as described previously.

EPA will evaluate the data and consider for use in the modeling platform. If the additional detail is needed more routinely, EPA will evaluate the more detailed SCCs for inclusion in the NEI as allowable SCCs and in national methods.

**Q17: When will the draft modeling platform including the 2011 emissions be provided?**

At this time, we expect transport analyses to be the driver for the timing, if the transport approach includes performing new modeling. Since we do not have a schedule for this work, we do not know the timing of the release of these data. The earliest possible time for releasing the draft modeling platform would be the fall of 2013. This response will be revised once a schedule has been determined.

**Q18: If I've missed the 2011 NEI v1 deadline, when will I be able to submit additional 2011 emissions?**

As the uses of the NEI v1 evolve and interim products released for review, we anticipate the need for a future revision to the 2011 NEI. We are planning for an NEI version 2 to incorporate information learned as a result of transport analyses and the 2011 NATA. Once the scope and schedules for these efforts are more well defined, we can determine the timing of when EIS can start accepting 2011 emissions again.

For the 2011 NATA, we are planning on doing preliminary point source risk runs and releasing the results of those later this year. We hope that these preliminary results will allow states to focus their attention on particularly interesting sources for NATA purposes and subsequent emissions or other inventory revisions.

**Q19: Will EPA use MARAMA's comments on representative counties in the MOVES runs used in the modeling?**

We took the feedback from the states along with other considerations related to state-submitted inputs, and we are incorporating that into our emissions estimates. The 2011 Draft (available since April) was run with older representative counties, and EPA is working now on an update prior to the NEI Version 1 with updated representative counties. The inventory and modeling are both iterative processes in which we try to improve the data involved.

**Q20: What data will EPA use for the oil and gas production sector in the 2011 NEI and modeling?**

For 2011 NEI v1 we will use state-submitted point and nonpoint emissions first. For states not submitting emissions we will use data output from the latest version of the oil and gas tool. This latest version will be one iteration newer than the currently public version, and it will include updates to the tool based on comments.

Because of the late timing of this latest version of the oil and gas emissions tool, it will not be able to be released until after we are done taking comments on the oil and gas emissions to be used for 2011 NEI v1. Thus, we will not have the benefit of state comments on that version to see how well it addresses previous comments. However, review of both the 2011 NEI v1 emissions and the oil and gas emissions tool will continue and have impacts on later versions of the 2011 NEI and modeling platforms.

**Q21: Will monthly data for on-road and nonroad mobile sources be available in addition to the annual data that is a part of the 2011 NEI?**

For EPA's MOVES (on-road) and NMIM (nonroad) emissions runs, we intend to continue to provide the resulting monthly data from those model runs as part of EPA's modeling platform development and review process. For states that provided EPA emissions data for use in the NEI, we do not intend to separately post monthly allocations of those emissions.



**Q22: How does EPA intend to address emissions from intermittent emissions sources associated with high electricity demand days (HEDD)?**

While we realize that emissions from these sources are not traditionally submitted to the NEI, there is no reason why emissions from such sources could not be submitted to the NEI through EIS. Ideally, EPA would receive the emissions in EIS and separately receive temporal allocation information for these sources (see Q13:). If this occurs, EPA could include HEDD emissions sources in the 2011 base case provided that the inclusion of these emissions in the future year can be done in a credible way.

If the approach described above is not possible, then EPA would consider using day- or hour-specific data files provided by states. Since EPA does not have much information on these types of sources, we would rely on the states for handling the following aspects of our trying to use these:

- Formatting the data into SMOKE input formats.
- Providing emissions of all relevant pollutants.
- Identifying and supplying appropriate SCCs, release point parameters, and other non-emissions inventory data
- Helping ensuring emissions are not double-counted with other sources in the NEI or future year emissions
- Collaborating with EPA on a scheme for including these emissions in future years
- Providing both base and future-year emissions

**Q23: Did EPA use the on-road and nonroad model inputs submitted to EPA for the 2011 NEI?**

We used as much state input data as possible, but resource and timing constraints have meant that we have not been able to use it all. Also, many of these inputs were provided after the December 31<sup>st</sup> deadline for the NEI. The inputs we used were prioritized to use those that have the largest impacts on emissions. As we continue improving the inventory, and as resources permit, we will incorporate more of the state-provided data as time goes on. This will also be guided by state comments in reviewing what has been done to date.

For model inputs provided in April, these are unlikely to be used in the 2011 NEI version 1. These will be incorporated into subsequent versions of the NEI.

**Q24: EPA's 2011 Draft emissions are very different from my state's best estimate of emissions. What is the best way to improve the estimates for use by EPA?**

States can still submit on-road and nonroad mobile model inputs through EIS. While there is a significant lag time between when we receive the model inputs and when we include them in an inventory, the sooner we receive those inputs the sooner we can start that process. In addition to the time it takes for models to run and data to be compiled, we also are impacted by other factors, such as contractor availability and the resources needed to incorporate the model inputs into EPA's national model input database. Thus, even having knowledge that model inputs will be forthcoming can be useful to EPA. Our contact for mobile model inputs is Laurel Driver and please refer to the [EPA Staff Directory](#) for contact information.

**Q25: Will EPA make SMOKE output files (inputs to CMAQ/CAMx) available to states?**

EPA can make these data available. We will evaluate different options for providing these data, since the files are so large. It has been suggested that regional modeling organizations could help EPA distribute these emissions, which is an idea that EPA is considering. Typically, files of this size are distributed only by shipping disk drives.

EPA is not sure when such files would be made available, since the schedule for our work has not yet been finalized. We understand that some states would like to get the data as soon as it's created, and EPA is considering whether such an approach is feasible.

**Q26: How will states be notified of data availability?**

EPA will continue using the same email list used to announce these calls. Please send an email to Marc Houyoux to be added to or removed from the list. Please refer to the [EPA Staff Directory](#) for contact information. Brian Timin intends to forward any announcements to his modeling workgroup email list as well.

EPA will also include NACAA in such announcements to help ensure wider distribution.

**Q27: How can states who are not familiar with running complicated models participate?**

EPA suggests that state participants review the emissions summaries that are posted for comment, comparing these to what it knows about emissions in their states. For temporal allocation, working with EPA regions or regional modeling groups could help states participants learn more about what is being done and aid in review. In addition, the model inputs are available for review, and some inputs are things that state participants may be able to review even if they are not familiar with running the models. Examples include vehicle miles traveled (VMT), vehicle mix, parameters of inspection and maintenance programs, and vehicle age distributions.

**Q28: Will the EIS facility inventory window be closed for updates to the facility inventory, even after the May 8<sup>th</sup> deadline?**

Yes, we have to close the facility inventory submissions while we are compiling an inventory. Once all of the inventory release components have been created (e.g., Selections in EIS for use in EIS reports, modeling files, and "large file downloads"), we can open the facility inventory window again.

We realize that we need to have EIS facility inventory open to allow for facility updates needed for the 2012 EIS submissions, due by 12/30/2013. The schedule for the 2012 EIS submissions will be provided in the near future. At this time, EPA's focus is the 2011 NEI.

**Q29: Will updates submitted to EIS by May 8 be in 2011 NEI v1 and in this summer's modeling platform?**

Yes for stationary sources, but it is less certain for on-road and nonroad mobile.

**Q30: Can EPA provide a spreadsheet/table that describes what will be in each sector in 2011 NEI v1 and v2, especially for oil and gas.**

What is included in the 2011 NEI v1 will be provided with the documentation. That will not be immediately available when the 2011 NEI v1 is available in the Emission Inventory System (EIS), but we will work to get that

information out as soon as possible. What is included in 2011 NEI v2 will be included in the documentation released for 2011 NEI v2. It may be possible to provide a summary table of what is in NEIv1 before the rest of the documentation is available.

Within EIS, reports are available that indicate the data sources for each record in the NEI. With the 2011 NEI Draft, EPA produced a summary that showed by state, data category, and pollutant, how much data was state data and how much was EPA data. Through EIS, additional details can be obtained regarding what datasets are included in the NEI releases.

**Q31: Can EPA put together a white paper for 2011 NEI v1 on-road? Will the activity data used be described?**

Documentation for the 2011 NEI v1 on-road mobile emissions will be provided in the 2011 NEI v1 Technical Support Document (TSD). To understand what is likely to be included, you can review the level of detail provided in the 2008 NEI v2 TSD (see <http://www.epa.gov/ttn/chief/net/2008inventory.html#inventorydoc>) and provide feedback if any additional detail is needed. Given staffing limitations, it is not possible to produce a separate “white paper” on this topic. Comments can be provided to Laurel Driver and Alexis Zubrow. Please refer to the [EPA Staff Directory](#) for contact information.

EPA will also post the input data used, including the VMT and vehicle population. For the 2011 Draft, VMT data are on FTP site as a national file. Summaries are also available. A README for the draft has also been posted and more complete documentation will be developed for v1.

**Q32: Is EPA considering using some of the biogenics data that west has used, which is different from EPA’s traditional use of the BEIS model?**

As of May 2013, OAQPS and ORD are collaborating to evaluate the use of MEGAN for national applications and also evaluate updated land use data in BEIS. EPA is planning to use BEIS for the 2011 NEI v1 and the first modeling platform, perhaps with updated land use data. It is not likely that EPA could use different biogenic models for different regions of the country, so the evaluations look at results from a national perspective.

The 2011 NEI v1 will include biogenic totals by county, with a separate Excel summary by state/month and county/month. Annual summaries will also be available from EIS. These summaries will match the emissions planned to be used for the initial modeling platform. States can use these summaries to compare to other emissions values from MEGAN or other models, and provide EPA with feedback on its biogenic emissions estimates. Such feedback can inform future improvements to biogenic emissions.

**Q33: What are EPA’s plans for using 2011 HAP emissions for 2011 NATA, particularly for the oil and gas production sector?**

EPA’s plans for 2011 NATA are still being developed. At this time, we plan to estimate risk using 2011 NEI v1 for point sources only. These risk estimates will be used to help focus attention on possible problem HAP data in 2011 NEI version 1 for point sources. We expect to run a final NATA on the entire 2011 inventory on a later version of the NEI, but the version that will be used is not yet known (but it will not be v1). We expect these later NEIs to include improvements (better than v1) to point sources from states, mobile sources, and nonpoint sources for key categories such as oil and gas production. As in past NATAs, there may be multiple iterations on inventories before release of the final data, providing additional opportunity for emissions improvements.